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APRIL, 1958

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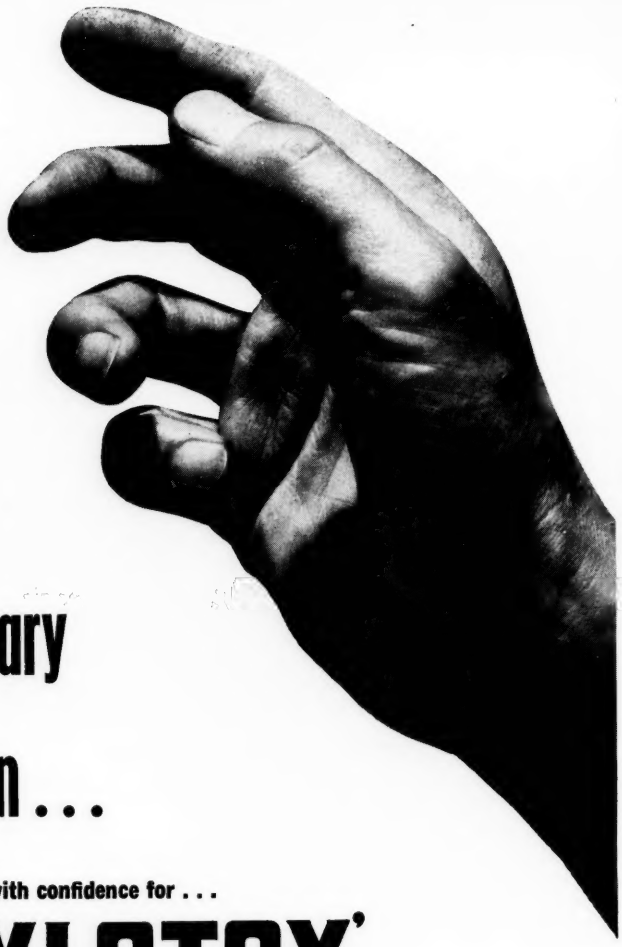

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THE BRITISH VETERINARY JOURNAL

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EDITORIAL

GENERAL PRACTICE

MOST of the students who enter the veterinary schools are attracted to a career in the profession because they have an inherent desire to alleviate the ills and misfortunes of the animal world or they have noted and envied the way of life of some practitioner and seek to emulate the skill and compassion which he exercises every day in the course of his work.

This means that the great majority of students who enter college hope to become competent general practitioners. As they progress through the strenuous course there are some who are attracted to the idea of a career in one or other of the specialised disciplines in which the wider range of knowledge and competence so essential for work in the field is not required. Many famous workers, past and present, in the specialised disciplines have not possessed and do not possess either medical or veterinary qualifications and their entry into a particular selective field has been based primarily on the possession of a degree in some other branch of science. As a rule the attainment of such a degree can be encompassed in two or three years and it does not entail the sweat and tears of a course extending over five to seven years.

There can be few who, in the first instance, enter upon the long trail of the veterinary curriculum with the sole idea of following a career in some particular specialist discipline. There can be no doubt, therefore, that destiny and the desire of most students must be to exercise their talents in the field. Now the man who enters into general practice has to be reasonably well founded in the basic sciences but also he has to be able to apply his knowledge in a practical manner so that his work can be of economic value to his clients. If he can do this his services will be in great demand and he will prosper. On the other hand, a more academically erudite man will starve if he lacks the ability to put his knowledge to practical use.

There is one other cogent factor which makes for success. A veterinary practice, like any other business, must be organised and conducted on sound and

efficient economic principles if it is to be of full benefit to the public and to the owner. The truth of this statement has been recognised always.

It is strange that in the long and tiring period of preparation before full legal qualification to practice the art and science of medicine or veterinary medicine and surgery is granted a student is left to wallow in complete ignorance with regard to the economics of the business which he aspires to conduct in his mature years.

If he should prove to be reasonably competent in his work the demands on his services will increase. He may work long hours and rush hither and thither in an attempt to cope with these demands and yet his own economic condition may verge constantly on to a state of insolvency. In the years when he is building up his reputation as a competent veterinary surgeon his time may be so fully occupied with the practical application of his skill that he has so little time for recreation and leisure that his health will suffer and for want of the time for study and contemplation he may stand in great danger of becoming academically sterile. Both factors pressage ill for his future.

The first few years of a professional man's life are the most important in this respect. If his zest for study abates he is in danger of becoming just a competent empiric or quack. If health fails the future can hold no pearls. The best solution is to combine the wisdom and experience of age with the enthusiasm of youth.

Old men are apt to be suspicious of and look askance at the young men who enter their area and the young men in turn may be intolerant of the rigid outlook which is so often associated with age. It is best when the hand of friendship rules then the young and the old can work together in amity and to mutual advantage. The old red fire can better temper and mould the young steel.

It is good, therefore, that men who have been through these things and have been fortunate to overcome the difficulties of combining scientific endeavour with a modicum of business acumen have come forward and given us, and especially those that are young and on the threshold of a professional career, the benefit of their experience. There is no doubt also that the remarks of the accountant who deals with the purely financial conduct of a veterinary practice will be read with great interest and appreciation.

THE ORGANISATION AND ECONOMY OF MODERN VETERINARY PRACTICE*

By L. GUY ANDERSON, M. YOUNG and H. N. GREENE

L. Guy Anderson, M.R.C.V.S., D.V.M. (Aylesbury)

I DO not claim to be an expert or an economist. It has been said that general practice is chaos. The task becomes the organisation of the chaos rather than the organisation of the practice. Organisation and economy cannot be separated entirely. No two practices are alike in every way, neither are veterinary surgeons. As a rule a practice develops around the personalities in it and organisation has to follow development.

The first thing to consider in the economics of practice is the amount of capital required when it is started. There are several ways of starting.

1. By purchasing the goodwill of an existing practice.
2. By purchasing a share in an existing practice.
3. By setting up one's plate. Sometimes the last method is frowned upon, but it is a perfectly proper proceeding, except in those cases where ethical or legal considerations make it undesirable. The purchase of a share or partnership is the most common method of acquiring ownership status in a practice. The purchase of a partnership is a thing which must be approached very carefully, seriously and honestly by all the parties concerned and particularly by the young man who is offered an assistantship "with a view to partnership". This method may lead to great dissatisfaction and trouble if the terms are not defined precisely and the "view to partnership" is vague and uncertain. Difficulties and ill-feeling may arise when the young man asks for the arrangement to be implemented. It is essential that all matters appertaining to the selling or purchasing of a share of a practice should be studied with great care and legal advice should be taken by both sides from the start.

Practitioners whose practices were established prior to 1939 are extremely lucky. Since the war two things have affected the economics of practices: (1) monetary inflation, and (2) actual inflation of veterinary work, especially in country practice. In many practices the turnover is from three to six times as great as it was before the war and the number of clients has not increased proportionately. There is much debate as to the value of a practice for the purpose of purchase or sale. Some think that value should be based on profit, others say that it should be based on the turnover. The latter is an indication of the amount of work being done, whereas profit depends in great measure upon management or administration.

Profit figures can be relatively false. If there are four men in the practice (the principal and three assistants) the biggest item on the expense side will be salaries. If the latter are at a high level the profit will be relatively less. In a practice conducted by four partners the professional salaries are nil and on paper the profits are greater. I am of the opinion that it is best if the value of a practice is based on turnover, but probably others may think that some combination of the two methods is best. This is where difficulty arises when a young man enters into a practice. He has to provide a relatively large sum of money for the purchase of

* Presented Central Division B.V.A.

his share, he has to purchase a car, a share of the drugs and instruments, maybe a house, and he has to earn sufficient money to justify his investment. If an assistant earning £1,000 a year has to invest some thousands of pounds in a practice he has got to be sure that his potential income as a partner is considerably in excess of his income as an assistant. The principal of a practice has to consider very carefully what he can offer for sale. He has to solve the difficult problems, what should be the set-up of staff? How many partners and how many assistants will the business carry? In my own practice there are two partners and two assistants and a third assistant is required at times at one branch and two partners and one or two assistants at the other.

Another problem is how long can one expect an assistant to stay? The answer is—not very long! The fellow who will stay as an assistant indefinitely is not the type one would select in the first place if there was free choice. If an assistant is an outstanding man, one has to decide, and it is a difficult problem, whether to take him into partnership so that his services can be retained or let him move on. Can one afford to be in the unhappy position of having a high proportion of the staff as temporary people who come and go? We all know the difficulties associated with frequent changes of assistants. The solution depends upon the gross turnover and on a reasonable assurance that it is not likely to drop. If the turnover should drop one might be in the position of having a whole group of partners, the practice over-staffed and no one earning a worthwhile living.

The management and economy of a practice provides many problems. Expenses are very high. Fees should give a reasonable profit and at the same time ensure that our services are of economic value to the public. We are expected to keep our practices up to date and use the newest and most efficient drugs. These are often the most expensive. We are expected to maintain adequate premises, lay staff and equipment. If we set our fees at too high a level we may " kill the goose which lays the golden egg ". Clients have their economic problems also.

In going through may accountant's returns for nearly 20 years, the following can be noticed—in 1939 my expenses were roughly 40 per cent of the gross. In some practices expenses were less than mine and were about 33 per cent of gross. Our expenses are now about 66 per cent of gross and that is with four partners out of a team of eight. We are showing salaries against less than half of our staff and still cannot reduce expenses below 66 per cent of gross. It means we have to work harder to get a living comparable with that of 1939. Taxation has increased so much that it is necessary to have a tremendous turnover in order to make a reasonable income.

One of the most difficult things facing a practitioner is working out the costs; the most difficult is to assess the value of overhead charges when arranging fees. The major expenses are drugs and mileage. There is not much difficulty in working out what is a reasonable percentage of profits on drugs and what are the mileage costs, but it is extremely difficult to know what to charge the clients for overheads. I wonder if we are making insufficient profit because we are not allowing enough for what were relatively minor expenses in the past but have now become major items.

In my own accounts drugs are 40 per cent. of gross expenses, wages including insurance are 24 per cent and transport expenses about 21 per cent. If we take out those three, only 15 per cent of the over-all expenses will go down as overheads. Even so, some of the overhead figures are very high. Telephones, stamps and stationery work out at about 3 per cent in my practice. In these days it can be very expensive to call clients by 'phone, and postage on medicines is considerable. It is essential to watch overhead expenditure but not to make too much of it if we are satisfied we are adequately covering our major expenses.

There is also the question of bad and delayed debts. People with farm practices are finding this a big problem. Money is very expensive and we all have to carry overdrafts, the main reason is that our clients owe us money. The favourite trick is to run up a large account to about £100 and then send a cheque for £25 to keep us quiet. The next account goes to £110 and then we get another £25. In the end we are lending £100 free of interest for 5 or 10 years! We must assess the value of the money outstanding and adopt appropriate measures for those people who are slow payers; one might be justified in charging more to such people to cover " interest ". One of the difficulties in assessing fees arises when we use drugs prepared by manufacturers. The price may be known to the public. It has been the practice in the country to make money out of drugs because farmers do not like to pay for advice alone. We have to sell medicine at a profit, not only to cover the costs of the drugs but also because this profit helps us to keep the charges for professional service and mileage within the client's economic horizon. Often it is difficult to charge a fee which will compensate adequately for the price of drugs, mileage and professional services. We have to assess the charges carefully. We must be careful not to charge exorbitant fees. This occurs rarely, if ever, in country practice, but it may occur occasionally in urban areas. If fees become too high free clinics are bound to flourish.

Life in a country practice is a hard grind. There is not a lot of horse work now-a-days. Cattle occupy our attention morning, noon and night. It is essential to organise leisure periods for the staff. One can arrange for organised leisure with greater ease if the clients are trained to co-operate. In my practice our attitude towards the clients is firm. There is always someone on call for emergencies but we will not go out in the middle of the night or at weekends to see cases which could have been seen days before or can properly be left until the next day. It is only by adhering to this policy rigidly that one can make provision for the organised leisure and recreation which is vital for the proper conduct of our work.

A happy practitioner tries to keep on good terms with his professional neighbours. Farmers are blamed for grumbling, but veterinary surgeons are worse! They complain loudly about two things. Either they have too much work to do or they are afraid that someone is trying to steal work from them—often it is both! In nine cases out of ten, there is no real reason for the bad relationships which occasionally occur between practitioners. There will be always a few clients who will dodge from one man to the other. If we are friendly with our neighbours we can deal with this type of client in a suitable manner and we can call on a neighbour for help and not feel that we have to be on the defensive the whole time.

I do not think we can lay down rigid rules for the organisation or economics of practices. The type and method of practice varies from one district to another. The owner of a practice must observe reasonable economic rules if he is to survive and remain solvent. He must observe professional ethical standards if he is to retain the respect of his clients and keep on good terms with his professional colleagues.

M. Young, M.R.C.V.S. (Ealing)

I will describe the organisation of my own small practice which is situated in a London suburb. It is based on a main surgery with branch surgeries. At the main surgery calls are taken throughout the day and night. Nurse receptionists are on duty in shifts from 8.30 in the morning until nine at night. Their duties are to take all calls, receive in-patients for operation, prepare for the rounds, surgeries and operations, assist in the restraint of patients—and sometimes owners—assist with anæsthesia and operations, deal with receipts and take in cash—a most necessary occupation—and generally keep the place clean and tidy. These girls are under a head nurse whose job it is to arrange the rota, keep the peace and send out the accounts. The head nurse is responsible in great measure for the smooth running of the practice.

Set surgery hours in the morning, afternoon and evening are taken either by myself or an assistant. Certain clients are seen by appointment.

The branch surgeries are open during the day. There is a nurse receptionist at each and fixed surgery hours which are taken by an assistant or partner. Each veterinary surgeon in the practice attends at regular times at one or other of the branches, so that any client he is attending at a particular surgery can see him or contact him there by telephone at a known time.

Requests for visits are taken mostly at the main surgery and are allocated to the veterinary surgeons throughout the practice, this allocation is based when possible on the client's preference. As far as possible we try to arrange that each client has a regular veterinary surgeon and is not visited by each member of the veterinary staff in turn. If calls come in late or have to be arranged for some particular time it is not possible to keep this system always, but in general it works very well. Evening and night calls are taken by the veterinary surgeon on duty, one or two being on duty each night and on Sundays.

Minor operations can be performed at all the branches, but major operations are diverted to the main surgery where there is adequate equipment for all surgical procedures. It is usual for two veterinary surgeons and two nurses to be in attendance for major operations.

The main surgery is situated on a main thoroughfare with a clinic of the P.D.S.A. two doors away on the one side, a doctor on the other side and a dental surgery opposite. Thus, frequently we are asked to examine cases of human dermatitis and dental caries, and where to put the proceeds of the jumble sale. Luckily my receptionists have a reputation for politeness.

The main advantages of this type of practice, as I see it, are that it is possible to give a reasonable 24 hours' service and yet for each veterinary surgeon to have

reasonable free time and, most important, know that it will be free. I cannot see how a single-handed practitioner in a big city, where free clinics attend to the needs of a large proportion of the animal population during office hours and then close up for the evening and night, can possibly give anything like a 24-hour service and remain in good health. Even if he accepts only calls from his clients out of hours he will still be pestered through the evening and night by those who think the clinic is so wonderful and they are so kind to the animals, "such a pity the clinic isn't open, if it had been we would not have bothered you".

In a multiple practice there is adequate help available always for difficult operations and anæsthesia and time to carry out some investigation of puzzling cases. Also, with five veterinary surgeons in the practice, it is possible to get varying ideas of procedure and method and some stimulating rivalry between one branch and another. The main disadvantages are the large amount of stock and capital equipment required and an inevitable wastage on mileage when working on the system of client preference.

On the question of economics, I will now make a few remarks, with which many may disagree.

The public must respect the professional man and I do not believe this respect is achieved by low fees. Some of the low fees charged, particularly for skilled surgery, may harm our reputation. For instance, until recently it was possible in London to have a cat spayed, a major abdominal operation, for 10s. 6d. The argument that if these operations are performed wholesale and at speed they can be done at cut rates applies to the production lines rather than to a surgeon.

The scale of fees in any practice must to some extent depend on the overheads. If the client wants attention for his pet at all hours of the day and night, a spotless surgery and modern equipment, he must expect these items to be reflected in the scale of fees. In my opinion there should be a fixed scale of fees in every practice and set fees for regular items such as spaying and castrations, visits, etc. For major operations the fee should depend on the responsibility involved. I consider it justifiable to charge an extra fee for work carried out in the evening and on Sundays after the end of the official surgery periods.

Drugs can be a heavy financial load, especially the modern therapeutic agents which so quickly become out of date and a large stock may become a dead loss. I find it better to issue a prescription for the expensive ointments, lotions and other preparations which are then obtained direct from the chemist. With injections, of course, this is not practicable and here it is important to know their actual cost so that a proper charge to cover their use and to allow for possible wastage may be made. It is especially important to watch the cost of accessories which are expended but not chargeable, i.e. cotton wool, thermometers, syringes, etc., but I do not advocate trying to save on permanent instruments and equipment which should be of the best possible quality.

Bad debts should not be a serious problem in an organised practice. Obviously, doubtful characters, particularly those who have been to a free clinic or who arrive out of hours, should not be allowed credit. It is important that accounts be sent out monthly.

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Bad debts should not be a serious problem in an organised practice. Obviously, doubtful characters, particularly those who have been to a free clinic or who arrive out of hours, should not be allowed credit. It is important that accounts be sent out monthly.

Lastly, I would like to say a few words on free clinics which, of course, do affect the economics of small animal practice. What other business or profession would tolerate this kind of competition? I feel that in the near future the large number of new graduates will not find the jobs available in large animal practices. Prosperity in this type of work depends in great measure upon M.O.A. activities. We have been told that the work will continue, but ministries have been known to change both their Ministers and their minds. The drug firms may feel that if a less prosperous time comes they can do without veterinary staff, and the British colonies, if there are any left, may have received adequate numbers. Many of the new graduates may try to find work in small animal practice and if they are to earn a living the problem of the free clinic must be solved. I know a lot of work has been done by the R.C.V.S. and B.V.A. but I cannot subscribe to the opinion sometimes expressed that our case is hopeless. It is up to those now engaged in small animal practice and supported by those who are not, to pool their ideas and resources in order to fight the menace of free clinics whether staffed with qualified staff or not and which do not give any service to the pet-owning public approaching that given by the veterinary surgeon in practice.

H. N. Greene, F.C.A.

Mr. Anderson has said that no two practices are alike, but, unfortunately, Tax applies to them all, and it is the tax problem with which mainly I will deal. There are some general remarks I should make first, however.

One or two points have been raised about capital, but Mr. Anderson has not gone into the way of supplying that capital. I will touch on that for those who are not in practice. Normally the first approach is through a bank, and interest will be charged at 6 per cent as no bank will lend at less than 1 per cent over Bank Rate. If one is unable to obtain the money through a bank, it is possible to approach a finance company. The chief concern of the latter is the net profit of the practice, and before lending the money they want to be certain there is sufficient net profit to provide a reasonable means of living, after paying tax, and to cover their interest. It is more expensive to get money from them as they may want 10 per cent to 12 per cent, as compared with the banks wanting 6 per cent to 6½ per cent. The third alternative, if you are desperate, and have some cash, is to buy part and to persuade the seller to leave part as loan, i.e. to put down part of the capital required and to pay interest out of profits on the part of the capital unpaid. When a man is retiring, however, he is usually in need of money and he is unlikely to leave part on loan. It can be arranged in certain cases.

Mr. Anderson's expense of drugs seems to be reasonable. In the majority of professional practices the percentage of expenses charged against turnover is 70 per cent to 75 per cent, and in some cases even 80 per cent. We must watch our expenses pretty closely. Tax has made a big difference and affects the chance any professional man has of getting a reasonable price. When a man wants to sell a practice, and there is a possibility of a junior buying his share, if the latter has not the capital he cannot buy out of income as he could in the old days when Tax was 4s. to 4s. 6d. and have enough to live on, pay his taxes, etc. That has gone by

the board, and I cannot see Tax being reduced to a reasonable level in our lifetime.

Tax relief concerns all of us. If one has a surgery in the house, one can charge a proportion of the rent or Schedule " A " and the same applies to rates, light and heat. These things help in the standard of living, and might enable one to keep a bigger place than otherwise. A salary can be charged for a wife, for keeping the books, answering the telephone and being on duty. It pays to pay a wife up to £500 a year, provided it can be justified, and so save money in effect by reduced rate relief on earnings. How long this will go on I do not know, but there is some talk of withdrawing that concession. If there is unemployment and women are not so urgently needed that concession might disappear.

Protective clothing can be charged for, and it is usually possible to get some sort of allowance for ordinary clothing spoiled in the practice, but that varies from district to district. I have had heated arguments with Inspectors of Taxes, but generally I have succeeded in getting something. One can charge for periodicals for the waiting room, but for professional books there is wide variance in treatment. Some inspectors take the view that we are buying books only to keep our knowledge up to date, and the favourite argument is that we are equipping ourselves to earn money and not spending money in the course of earning. That argument has to be tackled at the start, and the more we get our point home in the early days the better we will be treated later.

When buying a car, there is an initial allowance of 20 per cent and an annual allowance of 25 per cent and the 45 per cent in the first year might enable one to buy a slightly bigger car.

If money is borrowed from the bank, one can charge the interest in one's accounts, but with tax at 8s. 6d. in the £ it must be remembered that 11s. 6d. comes out of one's own pocket, and so it never pays to borrow if one can pay straight away. If that is not possible, and one obtains things such as equipment on hire purchase, there is an allowance on the money spent in the year. The initial allowance of 20 per cent is given on the deposit plus the instalments at the end of the fixed period.

The other point about allowances on cars and equipment is that if you sell you may be faced with a balancing charge. If you sell for more than the value to which the item is written down, you pay tax on the difference. Ordinary equipment normally does not carry more than 6¼ per cent, but on some items it is possible to get 12½ per cent. Usually, however, veterinary equipment carries a rate of 6¼ per cent.

On pensions, a self-employed person can get an allowance of 10 per cent per annum of earned income, and if they pay an insurance company to provide a pension for themselves, the pension must be taken between the ages of 60 and 70. The 10 per cent is subject to a maximum of £750 for people earning more than £7,500 unless they were born before 1915; it is 11 per cent with a maximum of £825 if born in 1914-15, with an additional 1 per cent for each two years prior, and if born before 1907 they are allowed to spend 15 per cent of earned income with a maximum of £1,125. The policies cannot provide for payment of a lump sum, except in the case of death before attaining the retirement age, when some policies

provide for the return of premiums paid. If death occurs before the pension age of 60 to 70, and it has been arranged to have repayments of premiums, some companies pay between 3 per cent and 4 per cent on the money which they have had. One can take out a similar pension payable to one's wife. Any insurance company will advise on these points.

BOVINE CYSTIC OVARIAN DISEASE: AN ANALYSIS OF 48 CASES

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Ministry of Agriculture, Fisheries and Food, Cambridge

Article 2

PART II

Economic-Therapeutic Aspects

Implications of the Incidence of Disease

The conclusion about the economic aspect reached in the review paper was, that there was a real need for more national and international data on the relative importance of the disease and especially in breeds other than the Friesian. Apparently the only data on overall percentage incidence that have been published relate to the Japanese Black breed, in which cystic disease was found in about 10 per cent of barrener discards. By inference it transpired that a figure of 5 per cent might apply to the German Spotted Mountain Breed. The material of the present study comprised barrener discard cows: Guernsey 130, Ayrshire 40, Friesian 14, Jersey, etc. 5; and the number of cases of cystic disease found for each of these breeds was respectively 30, 11, 4 and 3, representing percentages of 22.4, 27 and 28.6 for the first three breeds. The higher percentages for the Ayrshires and Friesians cannot be considered significant in view of the small numbers involved, but the measure of agreement shown with the Guernsey figures may well be so. The incidence figure of 48 cystic cases among the 189 barreners gives a percentage of 25.4, which is rather markedly in contrast with the evidence from earlier work. Recently Roberts has emphasised his finding that the incidence of cystic disease showed a steep rise over the period 1945-55. In a review the present writer discussed the evidence and suggested that this might be due to the progressively increasing importance attached to quick maturity and high yielding in dairy cattle, perhaps without much regard to conversion capacity or longevity, in the E. United States where Roberts worked. The suggestion was put forward that since husbandry conditions in Great Britain have been similar, the disease might be found to be more important economically in this country than the previous scanty foreign incidence figures suggest. Year-by-year analysis of the incidence figures from the present study confirm this view and the findings of Roberts. It gives also some indication of how the divergency between the present incidence figure of 25.4 per cent and previous assessments of 5-10 per cent developed. It is not claimed that

sufficient numbers have been studied to give conclusive proof but the figures given in Table V are highly suggestive.

TABLE V
Annual Proportion of Cystic Cases to other Barreners

Year	Cystic Cases	Total Barreners	Per cent
1953	4	23	17.5
1954	10	48	20.8
1955	19	68	27.9
1956	13	45	28.9
	to October 31		

It was during this four-year period that progeny testing on heifer lactations was introduced on a wide scale in this country. Garm showed the existence of a variable breed susceptibility to cystic disease. It developed at a younger age in Red Swedish than in Friesian cattle. In the review paper, reasons were given for suggesting that the cause might be that the Red Swedish were less uniform converters of feed as were the Friesian breed. Lousse and Cordiez proved, for limited numbers of experimental cows, that Jerseys showed a reduced uniformity as compared with Friesians. It was therefore of interest to evaluate the age at which the disease supervened for the group of cows now studied. The group contained an overwhelming majority of Guernsey cattle and an almost negligible proportion of Friesians. The mean number of calves produced by the group was found to be 3.73 per head before development of disease; that is, disease arose well before the completion of four lactations. This is about the age at which Garm's Friesians developed the disease, and a year older than his Red Swedish were, so that the new evidence does not confirm the increased susceptibility of the Guernsey that might conceivably have been expected from Hignett's (1950) evidence, that Channel Island cattle tend to reproduce less efficiently than other breeds, as well as possibly from Lousse and Cordiez' results. The figures obtained confirm, for British Guernseys and Ayrshires, that the disease, as in Sweden, tends to strike just when a cow should be attaining its prime of life and reaching its maximum production. In Sweden, it appeared that disease did arise most frequently at about the peak yield period of a lactation. The figures of Table V show no reflection whatever of the variation in incidence from season to season observed by Garm, which he attributed to climatic variations. Such variation may well have been "ironed out" by the overweighting influence of changes in husbandry conditions at a period when these are in a state approaching revolution.

Further Implications—Lactation

The evidence in support of the importance of hereditary factors in ætiology, which was surveyed in the review, seemed so overwhelming for so many breeds (7) that they may be assumed provisionally to be operative in the material of this study, although no new evidence on that factor is presented in the present paper. Nutrition taking effect through high milk yield was seen to be an inter-acting or complementary factor to the hereditary one. High yield in itself makes the pro-

vision of a completely adequate ration week by week practically impossible. The average basis of comparison for milk yields was taken from the Milk Marketing Board's average yield quotations for 1954-5, the middle period of the experiment, and the mean was taken of the Eastern and East Midland regional figures, as roughly equal proportions of the cows came from each of these two areas. The M.M.B. figures exclude the first lactation from the calculation, whereas the lactation-average for each cow affected with cystic disease studied, included the first lactation yield. On scrutiny of the range of figures this was let stand, as it appeared approximately to counter-balance the " extra " quantity of milk usually yielded by a nymphomaniac in her final lactation as a barrener—when the milk secretion was not, as in normal circumstances, limited by the hormonal demands of simultaneous reproduction. The heifer lactations in this series of cases were in effect found to be less than 10 per cent below the mean cow lactations, while second lactations did not appear to average any less than those of subsequent years. The yields of the disease-affected cows are accordingly believed to be directly comparable with the breed averages as computed by the M.M.B. Yields were computed throughout on the basis of a 305-day lactation.

Sufficient data were obtained for only 33 of the 48 cattle to be included in the analysis. Three others never came into milk. Nine Ayrshires averaged 8,850 lb. whereas the local breed average is 8,900. One of these had the quite abnormally low mean for her three lactations of 4,425 lb., and two others completed only two lactations each, one averaging only 5,526 lb. The average number of lactations for the complete series of cows approached four. The six remaining animals gave yields above the regional average, so that comparing the figure 8,850 lb. with the breed regional average of 8,900 gives no significant information. With regard to the Guernsey breed, 19 cows were found to average 8,563 lb., whereas the regional average was 7,976. Thirteen cows gave yields above the average, and six yields below it. Four Friesians, of which two completed only heifer lactations, averaged 10,869 lb as against a regional mean of 10,040. Over the 32 cows of the three breeds, 22 gave yields above their breed means, while of the 10 that failed to do so three completed only one or two lactations, and one other averaged less than half the breed mean on three. The evidence as a whole is probably significant, i.e., the disease is found most typically in the high-yielding cow. This affords satisfactory confirmation, and also data for the Guernsey breed, of the same conclusion drawn by Eriksson (1948), Garm, Vandeplassche, and Casida and Chapman (1951), from their study of Scandinavian, Belgian and North American material. The review paper stressed that it was the high yielders with, in Lagerlof's phrase, " a weak endocrine constitution " that succumbed. It may be thought that an important proportion of the residue which did *not* yield well had even weaker " endocrine constitutions ", as they succumbed three times without lactating, and in four other cases before the cessation of body growth, while an eighth survived to maturity as a quite exceptionally bad yielder.

A Controlled Trial of Therapy by Rupture

Since it appeared that a majority of earlier authors on therapy of cystic disease did not realise that the presence of endosalpingitis was the probable reason for

the continued infertility of 20-50 per cent of those cows to which they were able to restore a normal ovarian cycle, an essential preliminary control measure for this trial, was the assessment of the incidence of bursitis and salpingitis in the sample of material studied. Although the presence of visible bursitis lesions is, most commonly, an indication of endosalpingitis on the same side, it is convenient to consider bursitis and salpingitis separately, not only because each can occur not associated with the other, but also because either can by itself inhibit the reproductive process. The involvement of the organ of one side only produces sufficient impairment of function, in many cases, to cause the subject to be discarded as barren.

Bursitis on one side was found to affect 11 of the 48 cases, and bilateral bursitis three, leaving 34 with normal bursæ—70 per cent. Bilateral endosalpingitis, judged severe, was found in 11 cases; in six of these there could be no question but that tubal function was destroyed; the photograph is typical. In a further nine cases similar severe changes were found in the tube of one side only, while in 25 it seemed unlikely that the passage of an ovum through the tubes would be hindered, though in eight of these 20 animals there were slight signs of inflammation. Thus of 45 cases where sections were examined, 20 had severe salpingitis and 25 had not.

The proportion of tube-and-bursa involvement was heavier in the "simple" nymphomaniacs, just as was found with regard to endometritis. Only 20 of the 45 cases had both normal bursæ and open tubes; even here eight had slight tube lumen abnormalities. This proportion amounts to less than 45 per cent, and amply confirms the cause of continued infertility in up to 50 per cent when the cycle was restored, as reported by the other workers. The breakdown by hand of bursal adhesions, where tubes remained unaffected, might permit a slightly greater conception rate than the above results as first suggest, at any rate to 50 per cent. The vibriosis status of the herds of origin was known for 21 of the 48 cases. Three cows came from herds with recent histories of clinical vibriosis, while 18 came from definitely clear herds. There was no suggestion discernible that the damage to the organs was associated with *Vibrio fœtus* infection.

No previous worker from the therapeutic aspect appeared to have studied a series of control cases left untreated; thus a notable gap had been left in available knowledge on prognosis. No information had been found on the ovarian changes during the first five days following rupture.

The behaviour of the ovaries was studied in 17 cases treated by rupture and in 24 untreated controls, of which 12 were simple and 12 cyclic nymphomaniacs. In two of the simple cases in the control group, the condition was observed to develop in the course of the clinical study, but for the other 10, the minimum mean duration of the disease, prior to the clinical study, was 7.6 months. All 12 cyclic cases were apparently of long duration, but there may have been remissions in the courses of three; omitting these three the minimum mean duration was 8 months. Overall, 19 of the 24 controls had a minimum mean duration of just under 8 months. For the simple cases, the mean duration of the clinical studies was 20.3 days, with a range of 4-27 days; while for the cyclic section the mean duration was 33.1 days, range 19-76 days. The over-all mean duration for all the control cases was 26.7 days.

These clinical studies showed that among the simple cases there was one undergoing spontaneous resolution after one week, quite normal luteal phase genitalia being found post-mortem. In five the disease was certainly progressing, rapidly in two, including one of those in which disease developed during the clinical study from a normal cyclic state. Cysts 4.0 cm. in diameter were found at post-mortem examination on a cow which had exhibited an apparently normal cycle up to 10 days before death. The remaining six cases showed no change in the state of the disease during the clinical studies. As regards the cyclic cases, two exhibited a considerable degree of clinical improvement, including the establishment of one "empty-membrane pseudo-pregnancy"; in one cow the disease was progressing, while it appeared to persist unchanged in the remaining nine. Thus for the control cases as a whole there was one case of ovarian spontaneous resolution and two exhibiting clinical improvement, in 15 the disease persisted unchanged and in six it was definitely progressing.

The cases treated by rupture, numbering 17, included 14 simple and 3 cyclic cases. The mean duration of disease prior to the clinical studies averaged not quite seven months. In two cows the disease developed while they were under observation. The clinical studies had a mean duration of 28 days, with a range of 15-52 days. In seven cows rupture was carried out once only; in two groups of three twice and three times respectively, while in two it was carried out four times; in one, six; and in one, ten times. In four of these first seven cases a somewhat dramatic "cure" was effected, a normal ovarian cycle being restored without delay. All four cows were retained for 20-35 days from rupture to check this result. Two cases showed little change in the disease condition, cysts continuing to develop, though in each some (abnormal) luteal tissue was found, in one definitely attributable to rupture. The last case was slaughtered on the day following rupture.

It was to be expected that the mean duration of disease for this group, showing so favourable a response, should be only 3.0 months, when the over-all average for the whole treated group was about seven months, for it would be reasonable to suppose that the most recent cases would respond best to the initial rupture and there would be no indication for repeat treatment. In the cases where cysts were ruptured repeatedly, this was done at a mean interval of 10.4 days, with a range of 4-19 days. Two of the three cows in which rupture was twice carried out were slaughtered two days after second rupture. A cure seemed probable in one, judging by the normal rapid luteinising process in the rupture site; this was less marked in the other, in which only a trace of luteal tissue had resulted from the first rupture. in the third, an exacerbated case of eight months standing, complete and dramatic restoration of cycle resulted from the second rupture. This was proved by allowing the cow to survive for a further 30 days.

Two of the three cows in which rupture was carried out three times were slaughtered after three days; and the third after six. In the two simple cases rupture had some result, but a cure seemed unlikely; one showed at three days a young corpus luteum at a stage estimated at only 24-36 hours of normal development; the other at six days showed an abnormal luteal body of only 1.25 cm. diameter. In the third case, a cyclic one, rupture seemed to have no effect of any kind. One

of the cows slaughtered after rupture four times showed an effect less than that required for a cure, a miniature fresh corpus luteum only 1.0 cm. diameter, having resulted probably from the penultimate rupture. The other four-times-cyst-ruptured cow had a well-marked cycle restored, by the 2nd/3rd ruptures, despite which cysts still developed—conversion to a cyclic case of nymphomania. Some (inadequate) luteinisation followed fifth rupture in the cow subjected to the process six times, but ten consecutive ruptures in the last cow seemed to be quite without effect.

Out of the 17 cases, in six an approximately normal ovarian cycle was restored beyond doubt, normal corpora lutea occurring at autopsy. A similar result appeared probable in two more which were slaughtered 48 hours after final treatment. In two cases treatment did not appear to affect the disease in any way, while in the remaining seven, a varying degree of luteinisation, judged or proved inadequate to restore a normal cycle, resulted from the treatment. Some abnormal luteal tissue was present, in very small quantity at autopsy, in six of the 24 *control* cases, whereas after *treatment,* normal corpora lutea were present in six, normally developing bodies in two more, and abnormal luteal tissue in larger masses than from the control series, in seven, giving a figure of over 90 per cent yielding luteal tissue, half of it normal, from the treated series, as against 25 per cent, all subnormal, from the control series. Even though the mean durations of disease prior to experiment were respectively only seven, as opposed to eight months, the result of this trial seems to indicate and with some conviction that rupture is a highly effective form of treatment for the ovarian condition, and that this condition is much more likely to progress than resolve if treatment is not applied. No previous work appears to have established such conclusions so clearly. Three of the six cases in which a normal cycle was restored were affected with unilateral bursitis; a fourth with severe bilaterial endosalpingitis.

The course of events in the ovary in the days immediately following rupture was studied in a series of eight cases, one of which was slaughtered the day after rupture, three at two days, three at three days and the eighth after an interval of six days. After 24 hours the first of these cows showed no apparent change from the condition of a freshly ruptured cyst. Of the three cows slaughtered after 48 hours, two showed the usual small blood clots, and craters already well lined with luteal tissue, corresponding in volume to about 20 per cent of a corpus luteum. In the third case the cyst appeared to have reformed as twin cysts, each 1.25 cm. They were filled blood-clot. One of the cases, a cyclic one, on which rupture was performed three days before slaughter, showed no resultant stigma recognisable at autopsy. One of the others showed small bloodclots and a thin luteal lining to the cavity, a poor response, while the third showed a structure indistinguishable from a normal corpus luteum of 24-36 hours development. The final cow in this series showed one unaltered crater with bloodclots, and one solid fresh abnormal luteal body, 1.25 cm., with a barely detectable ovulation point. The series is extensive enough to show only that there is variation, both in the type and speed of the response—a very wide variation contrasted with that following normal ovulation. The study of greater numbers may confirm that some typical bright orange tissue appears by the second to third day in the treated nymphomaniac, a radical

difference from the normal, and not surprising, in view of the probable abnormality of the LH and LTH relationships.

Summary and Conclusions

Forty-eight cases of cystic ovarian disease occurred in a series of discarded barrener diary cows, collected over a period of four years from 95 farms in the south-east of England. These were studied for several weeks during life, and after slaughter by dissection, culture and microscopy. Seven cases or about 15 per cent appeared to be affected with adrenal virilism as described by Lesbouyries (1944) and Garm. Cystic glandular dilatation was a rather consistent finding. Thirteen of the 39 cases affected with nymphomania were proved, by means of the clinical study, to exhibit the typical syndrome alongside a continued, apparently normal, ovarian cycle, as had been thought probable by two earlier workers. The importance of the finding—" cyclic nymphomania "—in connection with diagnosis, and assessment of the results of treatment, is stressed. The remaining 26 cases were affected with " simple " follicular cyst nymphomania. The continuity and extent of œstrogen production was estimated from serial observations on behaviour, pelvic ligaments, secretory activity and the degree of opening of the cervix. The degree of vascular engorgement of the oviduct mucosa observed at post-mortem examination was a useful ancillary criterion. There appeared, perhaps only superficially, to be some correlation between the magnitude of the œstrogen production and the length of standing of the case. Ten cases were rated as " moderate " œstrogen producers, four as " high " and four as " very high "; in confirmation only this last four showed signs of pelvic bone denaturation. By the same standards six cyclic nymphomaniacs had " moderate " and seven " low " œstrogen production. The cyclic case series yielded 48.5 per cent of cervical samples positive for œstrous mucus, as contrasted with 81.5 per cent positive samples for the simple case series. Evidence was obtained that the disease involved both ovaries more often than had been believed previously. The mean diameter of the largest cyst from each case was 2.9 cm. The detailed clinical study showed that heat-like signs occurred in at least half of the cases, whose behaviour was rated as " anœstrous " suggesting that the possibility of cystic disease occurring, not associated with œstrogen production, may have, in the past, been considered unduly seriously.

In one-third of the cases the nymphomaniac uterus showed evidence of œdema and subnormal tone during the period of clinical study. This was less marked in the cyclic ones. The endometria in the cyclic series showed 25 per cent with severe endometritis, whereas in the simple series, the severe endometrites rose to 45 per cent, with a further 23 per cent showing a moderate endometritis. Nine of the 34 cystic cases yielded possible pathogens in high density on culture, chiefly *C. pyogenes*, while in a control series of 34 non-cystic barreners they were found in only four cases. Nine cases yielded smaller numbers of organisms, so that only 47 per cent of uteri were organism-free, according to the culture techniques employed. Thus Garm's hypothesis that the uteri from cystic cases which he studied were atypically germ-free was confirmed. These results are considered to provide further evidence in conformity with the experiment of Weinstein, Gardner and Allen (1937) on mice that continuous œstrogen stimulation of the reproductive system may con-

duce to an increased tendency for the uterus to be invaded by organisms of the normal vaginal flora.

"Intermediacy" as between nymphomania and adrenal virilism occurred in at least 20 per cent of cases, thus confirming Vandeplassche's observations on this subject.

From the economic point of view, the percentage incidence seemed to vary little as between Guernseys, Ayrshires and Friesians; an over-all figure of 25.4 per cent for barrener discards was arrived at, but the incidence rose steadily year by year from 17.5 per cent in 1953 to 28.9 per cent in 1956. This observation is in line with observations made in the eastern United States, 1945-55. The number of calves produced before discard averaged only 3.7 per head. Evidence on the tendency to inherit the disease is not presented in this report, though such a tendency was considered to have been manifest. It was observed that 22 of 32 cases gave mean lifetime lactations above the regional average for the breed, the mean lactations of these 22 rising to 8 per cent above these averages.

The results appeared to indicate that the present prevailing husbandry and breeding polices are the direct cause of the rise in incidence observed, which may well be expected to continue. A controlled trial of therapy by rupture was carried out, involving 17 treated cows and 24 untreated controls. Only 40 per cent had normal ovarian bursæ, and oviducts which appeared to be functional. In six of the 17 treated cases, treatment restored an ovarian cycle apparently normal in all respects; and would probably have done so in two more which were slaughtered two days after the final rupture. Some, suboptimal, luteinising effect followed rupture in seven other treated cases. Among the controls there were three showing resolution or improvement, while the disease remained unchanged in 15 and actively progressed in six.

Thus, for the first time, a measure of positive proof seems to have been obtained that treatment, and indeed very cheap and easy treatment, is quite effective in the control of the disease. As only 18 of 41 nymphomaniacs, or 23/48 including virilism cases, had received any treatment at all before they were discarded from the herd, it may be advisable as a nation-wide short-term policy, that a broad extension of the application of rupture therapy be instituted. A long-term policy for control of the disease would require a radical revision of aims and methods in both breeding policies and husbandry. Though perfectly practicable this is unlikely to be put into effect in this country for some time, possibly not before the loss of the best producers in their prime rises even to much higher proportions.

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A REPORT ON REPLACEMENT ARTHROPLASTY IN THREE CASES OF HIP LESIONS

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THIS report concerns the progress made by the animal which was the subject of an article in the BRITISH VETERINARY JOURNAL, February 1956, Vol. 112, No. 2. Reference is also made to two cases treated similarly.

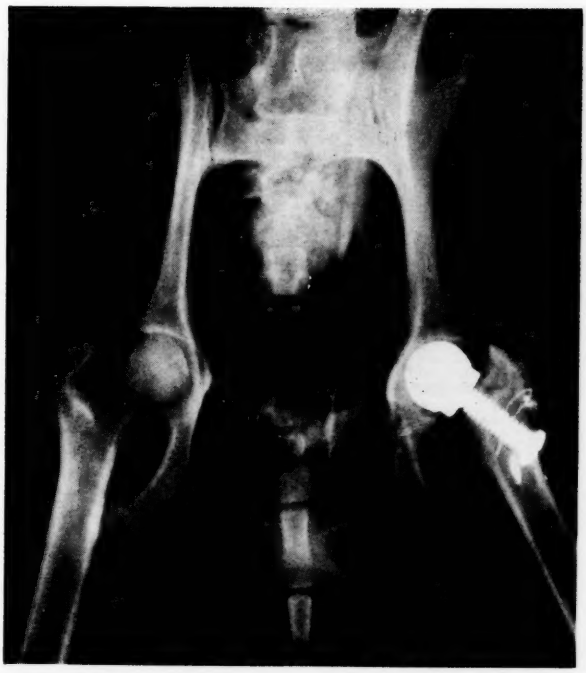
The animal was an eighteen months old miniature Poodle dog which had been lame on the right hind leg for nine months due to osteochondritis coxa. The operation of replacement arthroplasty which took place on December 12th, 1955, was described in the original article together with the fact that limb function was normal at the time the report was written, i.e., about two months after operation.

During the past two years the animal has been re-examined on seven occasions and finally on December 4th, 1957. It can now be reported that, up to the time of writing, function of the right hind limb remains normal. The X-ray film illustrated shows no significant differences in the appearance of the joint by comparison with the X-ray film published in the original article. It is perhaps interesting to note that there is no evidence of reaction in the peri-acetabular tissues.

Two other cases of osteochondritis coxa in the dog have been treated similarly. The first, a West Highland terrier bitch aged fourteen months, had been painfully lame on the left hind leg for many months. Replacement arthroplasty was undertaken in July 1956, using the same technique employed in the Poodle. The result was good although slight lameness persisted until the end of May 1957 when severe lameness developed suddenly. X-ray examination showed the stem screw of the prosthesis to be fractured. Another prosthesis of the same size was made and an operation to substitute for the fractured appliance was undertaken in June 1957. After about three months the limb was functional but some lameness persisted.

A second case concerned a six months old mongrel dog which had sustained a fracture separation of the capitular epiphysis of the right femur. Operation on the same lines as those of the other two cases was carried out, but upward luxation of the prosthesis occurred shortly after the operation was completed. It was decided to make no attempt to reduce the luxation immediately but wait for a week or two

PLATE I



Poodle dog aged about 3½ years. Radiograph taken 2 years after replacement arthroplasty.

(*Article by C. Frost and G. C. Knight on page 142*)

PLATE I

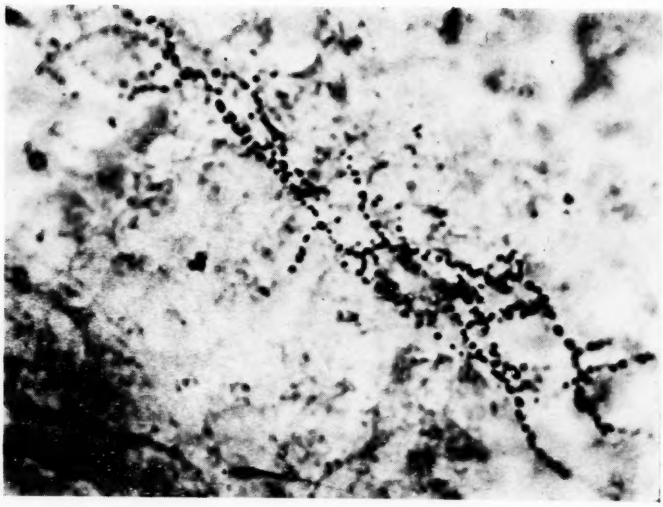


FIG. 1
Showing uneven staining.

FIG. 2
Showing the organism.

(Article by E. N. Dafaalla and H. M. Gharib on page 143)

and then review the position with the hope that possibly manipulation under general anæsthesia might prove successful.

The wound healed normally and the sutures were removed about ten days after the operation and, as anticipated, the prosthesis was still antero-dorsally displaced in relation to the acetabulum. The limb was being carried. The dog, however, was not brought for examination again until months had passed when the limb function was found to be almost normal in spite of the persistent prosthesis dislocation. Unfortunately the dog was not seen again. The owner telephoned about six months after the last examination stating that destruction had been necessary on account of meningitis following distemper.

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A STUDY OF MASTITIS IN A GOAT CAUSED BY NOCARDIA ASTEROIDES

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Case History

In September 1956 a three-and-a-half years old goat had a fistula in the right "quarter" of its udder. It was treated by surgical interference with apparent success.

On 2.4.57, the goat was brought to the clinic with a swollen udder. This had been observed by the owner two weeks before. The affected gland was hard, painful and greatly enlarged resembling a big tumour. It yielded whey-like milk on pressure. The animal was depressed and its temperature was 106° F.

The gland was infused daily with penicillin for six days and later with a mixture of penicillin and terramycin. No improvement was observed. On pressure caseous masses and necrotic debris could be forced through the teat canal. Drainage gave temporary relief but the gland became distended again within a day or two.

Antibiotic treatment was discontinued when bacteriological tests showed the causal organism to be resistant to penicillin, terramycin and streptomycin. Irrigation with a solution of 1 in 1,000 acriflavine was substituted and continued every other day for three weeks but without success. Meanwhile, the second "quarter" became affected and eventually it was necessary to remove both glands surgically.

Pathology

Macroscopically: The udder was enlarged and contained a great number of nodules varying in size from a pea up to a hazel nut. The nodules contained yellowish-grey caseated material surrounded by a well defined capsule. The nodules were spherical in shape. The remaining udder tissue was firm.

Microscopically: The nodular lesions had a core of necrotic tissue surrounded by a zone of chronic inflammatory reaction. The central areas of necrosis were

suppurative rather than caseous, outside these areas mononuclear cells with infrequent giant cells were observed. Lymphocytes and occasional polymorphs were present and there was a peripheral fibrosis. The parenchyma of the udder was atrophied and the interlobular connective tissue was greatly thickened. The general appearance of the lesions was that of a granuloma with giant cell formation.

Bacteriology

Morphology: In smears made from the caseous masses, a gram positive organism occurred. It exhibited branching filaments and a characteristic granular appearance probably due to uneven straining (Plate I). The filaments were acid fast retaining carbol fuchsin after decolorisation with 10 per cent sulphuric acid for two minutes but were not acid alcohol fast.

In culture, the characteristic feature was pleomorphism. The organism occurred in the form of filaments, bacilli, cocci and ovoids to such an extent that it was difficult to imagine that the various forms belonged to a single species (Plate II). Though all forms retained Gram stain, their reaction of Zeihl-Neelsen stain appeared to vary as there was a tendency for the spherical forms to decolorise more easily than the bacillary and filamentous forms.

Growth: This was obtained easily in ordinary media. In nutrient broth, a granular pellicle developed in 24 hours. This became rough on the second day; some of it disintegrating and falling to the bottom leaving the bulk of the column between the deposit and pellicle practically clear.

On nutrient and blood agar non-hæmolytic pin-point colonies became visible in 24 hours, enlarging to a diameter of about 1 to 2 mm. in 48 hours. The colonies had finely filamentous edges which were embedded slightly in the medium. On the third day the colonies assumed a warted appearance with V, Y, and star-shaped patterns of lemon yellow colour which were clearly visible with an eye lens.

On potato, lemon yellow growth became visible on the third day.

Biochemical reactions: The organism failed to ferment glucose, sucrose, lactose or mannitol. Indole was not produced. Gelatin was not liquified and litmus milk was not changed but the indicator tended to become decolorised with 10 days' incubation. Nitrates were reduced to nitrites.

Biologically, the inoculation of 0.5 ml. of a 2 days old second broth sub-culture intraperitoneally killed a guinea pig in 26 days. The animal appeared normal for about a week. Afterwards it showed gradual signs of exhaustion and emaciation. Post-mortem examination revealed numerous small abscesses covering the peritoneal and pleural surfaces, liver and spleen. Smears made from the abscesses showed the filamentous form of the organism.

Discussion

Animal nocardiosis in the Sudan has been known to occur in cattle caused by *Nocardia farcinicus* and in dogs caused by *Nocardia canis*. Until the present case, the disease had not been recorded in goats.

Frequent references have been made in the literature of lesions caused in goats in other countries by *Nocardia caprae*. According to the Medical Research Council Special Report (1935) the characteristic features of this organism are its pink growth

and the early development of aerial hyphæ which have a tendency to form spikes on all media. Topley and Wilson (1948) described the organism as non-acid fast. In these respects, *Nocardia capræ* differs from the organism isolated by the writers who consider that the properties which have been described in the text closely agree with those of *Nocardia asteroides* as described by Bergey (1948). This was also confirmed by Mr. P. K. C. Austwick, of Weybridge Laboratories, and Dr. G. A. de Vries, of the Pasteur Institute, both of whom identified a culture sample as that of *Nocardia asteroides*.

Apart from man, in whom *N. asteroides* is known to cause lesions (Eppinger 1891, MacCullum 1902, Henrici and Gardener 1921), a similar organism has been isolated from cattle (Bishop and Fenestermacher 1933, Monocchio 1956) and from dogs (Belazot and Perrot 1936, Ginsberg and Little 1948, and Bohol 1953). So far as the writers are aware from the available literature, the organism has not been isolated from goats previously.

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Thanks are also due to Mr. P. K. C. Austwick, of Weybridge Laboratories, and Dr. G. A. de Vries, of the Pasteur Institute, both of whom identified a culture sample of the organism.

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FRACTURE OR CONGENITAL DISCONTINUITY OF THE FIBULA IN THE HORSE

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IN the rœntgenography of the stifle joint or of the proximal parts of the crural region in horses examined for lameness we have encountered quite often a break of continuity in the fibula. In the beginning we diagnosed such discontinuity as a fracture, especially if stifle joint and both bones appertaining to it were rœntgenographically unchanged. However, after having observed such breaks even in instances

where the cause of lameness could be established—both clinically and by X-ray—as being due to a severe gonitis, we began to doubt whether the lesions were really fractures. The localisation of the breaks did not favour their being accepted as fractures. They were observed most often in the region of the proximal epiphysial groove (synchondrosis epiphysica), thus giving rise to the suspicion of their being non-ossified epiphysial cartilage. Evident contradictions appeared in this regard also. The location of many of the breaks was notably distal from the proximal epiphysial groove, their outlines were generally neither smooth nor horizontally placed but appeared rather irregularly dented and directed obliquely. Also, the distance between the unconnected bones did not correspond either to the epiphysial groove nor to a fracture. While some of the breaks were less than 1 mm. in width we met with others measuring several centimetres. To make the picture more complex, we observed also all stages of union between the proximal and distal parts of the fibula.

In the literature, we noted Ueberreiter's warning: " to be most careful when performing X-ray examinations as, in the horse, there were epiphysial grooves to be found in the region of the fibula which could be easily mistaken for fractures," and, in Müller's Atlas of Bone Disease in the Horse, there is a rœntgenogram presenting a break in the continuity of the fibula which he took for a fracture.

In the American literature of the last four years there were several publications on fractures of the fibula accompanied by more or less pronounced lameness, the ætiology of which was not clear and the clinical picture varied. Articles on " Fracture of the Fibula in the Horse " (Lundvall 1956) on " Fibular Fracture in a Filly " and "A Phenomenon in Equine Lameness " (Lusk and Rosborough 1957), there were recorded more than 80 of such fractures in horses.

Our clinical and rœntgenological observation induced us to begin, as early as 1952, to investigate the rœntgenological as well as the anatomical and histological aspects of the fibula in a large number of healthy horses of different age groups. (B. Žeškov: " Discontinued Course of the Fibula in the Horse," Vet. arhiv, book XXIV/1954, volume 7-8, pp. 178 to 184, and Ž. Dolinar: " Fibula Partita beim Pferde " Verh. Anat. Gess. report for the 52nd Congress of Anatomists in Stockholm, August 1956) and, on the other hand, to examine the clinical picture of such fractures on artificial fractures and lesions of the surrounding tissues.

Rœntgenological Examination

We endeavoured to examine the largest possible number of fibulæ in horses of all ages possessing unimpaired function of their limbs. With this object in view we took radiographs of both fibulæ in a total of 120 horses aged from one-and-a-half to 23 years.

Normal fibulæ in both limbs were found in 42.5 per cent of the animals. The fibulæ, in one or both limbs, were not complete in 57.5 per cent of the horses. Of the 69 animals in which the fibulæ were disrupted there were 20 in which the break was in one and 49 in which it occurred in both fibulæ and 19 animals had two or more breaks in the same fibula.

It is noted in the literature that the discontinuity might derive from non-ossified epiphysial cartilage or from a fracture. As it is not known at what period synostosis

between proximal epiphysis and diaphysis of the fibula occurs, the age of the horse does not serve as a safe basis for deciding whether the break corresponds to an epiphysial groove or a fracture. It was necessary therefore to establish as exactly as possible the localisation of the break. In two-thirds of the animals it was found to be in the area of the proximal epiphysial cartilage, and in one-third, more proximal or distal than that, even as far as 12.5 cm. distal from the head.

With the major part of the breaks corresponding by their localisation to the proximal epiphysial cartilage, the question arose as to the relation prevailing between the discontinued fibulæ and the age of the horse. Of 67 animals one-and-a-half to 7 years of age the fibulæ were observed to be ossified in 25; of 39 horses 8 to 14 years old they were ossified in 16, and of 14 animals aged from 15 to 23 years there were nine.

The interval between the unjoined parts of the fibula ranged from 1 to 61 mm., but in 93.2 per cent this distance amounted to less than 4 mm.

In estimating the character of the disruption we must consider its outline. The tubular bones in the area of non-ossified epiphysial cartilages present smooth, straight and approximately parallel outlines. Of a total of 118 non-ossified fibulæ only a quarter had smooth, straight and almost parallel outlines of the disruption, thus simulating the picture of unjoined epiphysis and diaphysis. The remaining 75 per cent demonstrated a great variability in shape, course and the mutual relation of both outlines. These outlines were in the most part either indented, irregularly notched, concave, convex or running an irregular course. They are at times sharp and clear, but often they are hardly discernible for the interlying space being filled in with more or less dense bone tissue. In many of the fibulæ the ossification had advanced in such measure that the outlines of the break had been obliterated completely, so that the discontinuity could be detected only by the differing structure and transparency of the already ossified interval. The direction of the break is transverse in a small per cent of cases; most often it runs obliquely, in the direction of the long axis of the fibula. The angle may be acute, or obtuse. In a small per cent of cases the outlines run parallel. Often they close an acute angle between themselves. Sometimes one is convex and the other concave so that their pattern on the X-ray film reminds us of a joint. As a rule the proximal and distal part of the unjoined fibula runs on the same axis, though we noticed in two of the cases the distal part to be dislodged slightly to the side as it is in a fracture with " dislocatio ad latus." Between the unjoined parts of some of the fibulæ bone particles were interpolated ranging in size from that of a grain of millet to a bean, and presenting, because of their irregular shape, the impression of bone splinters. The unjoined parts in the area of the disruption are quite often thickened and clubbed. If synostoses develop in such fibulæ, they are reminiscent of healed fractures in which reduction of the primary callus had not taken place. As already emphasised, all stages of joining or healing can be observed on the fibulæ, sometimes taking place in part only, so that many fibulæ look as if they had undergone fissure. In consideration of the indented and irregularly notched outline, the different directions, the already mentioned " splinters " and the manner of healing, such discontinuities cannot be differentiated rœntgenlogically from genuine fractures.

Sex plays no role whatever in the phenomenon of disrupted continuity, the discontinued course of the fibula occurring at almost the same ratio in either sex.

Anatomical Examination*

Anatomical examination was made on 246 fibulæ. The horses were mostly of the native cross-bred cold-blooded strain, aged from 2 to 19 years. In consideration of the great variability in shape, length and manner of synostosis between the capitulum and the corpus as compared with the "normal" fibula described in the standard literature, the bones were arranged in 3 groups:

1. In "normally" developed fibulæ the head and the body are completely grown together and extend to about half the length of the tibia. This group comprises about 30 per cent of the bones examined (Fig. 5A).

2. The group constituted of fibulæ in which bone head and body are joined only in part. On the site of the transition we observed an uneven, disrupted groove, or, more rarely, dotted depressions; on the median side there commonly appears a thickening or 2 to 3 pointed ridges (Fig. 5B). This group, comprising about 16 per cent of the examined fibulæ was designated as fibulæ emarginatæ.

3. The bone tissue in this group is completely severed. The break is located either at the junction of the head to body of the bone or within the body itself. Sometimes one fibula presents 2, 3 or more disruptions, so that the bone decomposes by maceration into 3, 4 or more parts (Tables 5C, D, F, and G). Intercalated between the individual bone parts there is an amorphous, cartilage-like mass of connective tissue that is an extension of the connective tissue enveloping every fibula. The direction of the break is generally oblique and its outline dented. In certain instances the length of the break would extend to several centimetres. To this group comprising about 54 per cent of the fibulæ examined we have applied the designation of fibulæ bi-, tri-, multipartitæ.

The horses in each of the three groups were from 2 to 19 years of age.

Histological examinations, which are of decisive significance, demonstrated great variability—as had also been encountered in gross examination. Typical discontinued fibulæ of groups 2 and 3, in foals less than 2 years old were selected for histological examination.

The fibula of the foal (Fig. 5H) presents, only 2 cm. below the proximal edge of the capitulum, an uneven cartilaginous belt of 1.2 mm. thickness, atypical for the epiphysial discs of the other tubular bones in which they run at equal intervals and circumferentially to the terminal border. The epiphysial disc itself in the foal conforms in its structure to the pattern on normal epiphysial cartilage of other bones. In the lower part of microphograph 6 rows of osteoblasts are seen which form the basic bone substance of the diaphysis. In the centre there is hyaline cartilage with the characteristic columns of multiplying cartilage cells typical of a normal epiphysial disc. Above, we see new cartilage cells and the spaces between columns of spongy bone substance. Such findings of normal epiphysial cartilage were not encountered in older horses, where the sites of the discontinuity present different degrees of delay in the development of the epiphysial disc, i.e. necrosis of cartilaginous tissue, irregular cavities and fissures, calcification of decomposed cartilaginous masses, disintegration and softening of the bone and degeneration of cartilage cells with the appearance of the collagenous fibres of compact connective tissues. Figure 6

* This part is extracted from the dissertation Z. Dolinar : Morphological Examination of the Fibula in Ungulates.

demonstrates a section of the fibula at the site of its discontinued course in a 6-year-old horse. In the middle of the plate we see a necrotic, decomposed and amorphous mass forming a belt of cartilaginous tissue with cavities in the central and the upper right part. In the upper region towards the epiphysis we discern cartilaginous cells in the stage of division and their transformation into osteoblasts, while in the lower part towards the diaphysis we observe osteoblasts and bone tissue in disintegration. In none of the examined specimens could we establish the presence of periosteal ossification (procallus, callus) which would speak for a discontinuity of the fibula on the basis of fracture, neither could we find normal epiphysial cartilage in animals above two-and-a-half years of age.

Surgical Examination

It was the contradiction between our experiences garnered at the Surgical Department of the University Hospital, where for 18 years we encountered no fracture although horses from the main bulk of our patients, and the number of fractures reported by American authors that prompted us to study by the experimental way the clinical picture of the artificially fractured fibula. As fracture of the fibula cannot be effected without simultaneous injury to the surrounding tissues, we extended our experiments so as to include also lesions of the tissues anatomically connected with the bone.

All the horses which underwent experimental surgery were examined every day for 1 to 2 months after the operation.

The fibula was fractured in 4 horses. The wound was closed with sutures. Directly after surgery difficulties in extending the limb forward were observed, particularly when trotting. There was a slight dragging of the toe. The abnormality of gait were reminiscent of those associated with paralysis of the peroneal nerve. The lameness diminished gradually and disappeared finally before the surgical wound had healed. One month after the operation X-ray revealed that no callus formation had taken place on the artificial fractures of the fibula.

We also induced luxation of the fibula simultaneously inflicting gross injury to the corresponding part of the tibia. The disturbances arising after this operation and their course corresponded to those observed in the preceding test. In one horse beside effecting luxation we severed the lateral femoro-tibial ligament also. The post-operative disturbances in this experiment were in compliance with those observed in the first and second test. In one animal a part of the tendon of the lateral digital extensor was removed slightly above its juncture with the tendon of the long digital extensor. No post-operative disturbances were observed. Beside dividing the tendon of the lateral digital extensor we severed also the tendon of the flexor hallucis in one horse. Directly after the operation the same disturbances as in the preceding experiments appeared accompanied by instability of the phalanges of the extended leg and the hoof was placed on the ground " from heel to toe " as in laminitis. The animal temporarily assumed a posture comparable to that seen in partial rupture of the deep digital flexor, i.e. slight raising of the basal border of the toe. The difficulty in extending the limb disappeared in a few days after the operation.

In order to render more complete the clinical picture in cases of trauma sustained by the fibula, we took into consideration not only the muscles connecting it but also

the corresponding part of the tibia. The lameness ensuing post-operatively was—with the exception of the last test—always of the same type and of short duration. It arose probably from a partial motor dysfunction of the peroneal nerve, associated with the pre-operative local infiltration with anæsthetics or with mechanical injury to the branches of the nerve inflicted at the time of operation. In cases of injury to the head of the fibula injury to the peroneal nerve should be expected, and the motor dysfunctions arising from paralysis of the nerve, are likely to arise. It is hardly possible to imagine fractures incurred in the other parts of the fibula because of its great flexibility and the topography of the bone. An attempt was made to fracture the fibula, by means of trauma, without injury to the skin. Radiographic examination after hitting the lateral crural region of a dead horse with a metal rod weighing 7 kg. demonstrated the fibula to have remained intact.

Discussion

According to rœntgenological and anatomical examinations performed on about 250 native crossbred horses of both light and heavy type, it was established that in over 50 per cent of healthy horses the head and the body of the fibula, and also individual parts of the body do not complete synostosis at any time of their existence. About two-thirds of such discontinuities correspond to non-ossified epiphysial cartilage. Our morphological investigation yielded negative results as regards the normal structure of the synchondrosis epiphysica in older animals and as regards the fracture; even in histological specimens it was demonstrated that at the site of the transition from capitulum to body there appear—instead of normal hyaline cartilage—degeneration and necrosis of the cartilaginous tissue, calcification of decomposed masses, even connective tissue. The interval between the ossified parts of the body were filled in with connective tissue. The discontinuities at the site of transition from capitulum to body and within the the body itself generally do not correspond even in shape to a normal epiphysial synchondrosis. Their outlines are very often dented or jagged, irregularly notched, mutually concave or convex, and, only in exceptional instances, straight and smooth as they are in normal epiphysial synchondroses. In most cases the breaks run obliquely making an acute or obtuse angle to the longitudinal axis of the bone. All stages of joining of the bone are met with, so that it is impossible to differentiate on the radiograph such discontinuities from fractures at different stages of healing. The similarity with fractures is still further enhanced by encountering at times two or more breaks in the course of one bone, so that their radiograph reminds us of a compound fracture with sequestræ.

If such an X-ray picture of a healthy but rudimented fibula in the horse is considered, it is not surprising that those breaks in the continuity of the fibula are easily mistaken for broken bones in spite of their having nothing in common with fractures. Yet, while we are warned by Ueberreiter to be wary when diagnosing fractures of the fibula, Lundvall, Lusk and Rosborough, as well as other Americans, have diagnosed every failure in synostosis established by radiograph as fracture of the fibula without consideration of the clinical picture which, in itself, often speaks against a fractured fibula. The only symptom, aside from lameness, is myositis of the lumbar and gluteal muscles. In cases of lameness in one leg they found discontinuity in both fibulæ, and, in one foal destroyed because of " fracture " of the fibula, they do not

PLATE I

FIG. 1
Break of continuity 9.2 cm. distal from proximal end of fibula.

FIG. 2
Break of continuity 8.7 cm. distal from proximal end of fibula with clubbed thickening of unjoined parts.

FIG. 3
Double break of continuity in fibula; partial synostosis has taken place in the proximal one.

FIG. 4
Double break of continuity in fibula. A bone particle is interpolated between the unjoined parts of the proximal break.

(Article by B. Zeskov, J. Marolt, E. Vukelic and Z. Dolinar on page 145)

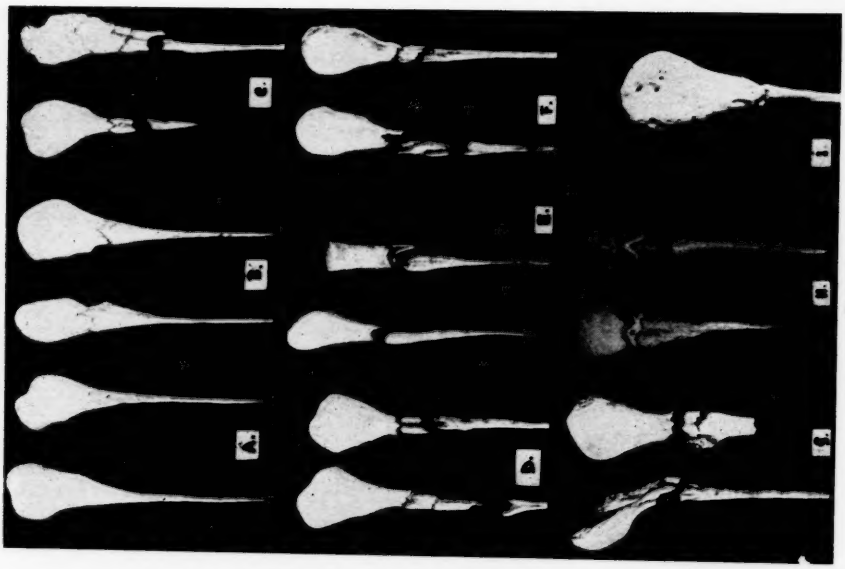

FIG. 5
Various types of breaks in continuity.

FIG. 6
Section of fibula in a 6-year-old horse.

(Article by B. Zeskov, J. Marolt, E. Vukelic and Z. Dolinar on page 145)

Various types of breaks in continuity.

PLATE I

FIG. 1
Clear white zone of new epithelial cells after three days of the use of Biœstrogen ointment. (Horse)

FIG. 2
Wound treated with powder after two days.

FIG. 3
Wound treated with powder after eight days.

FIG. 4
Wound treated with Biœstrogen after two days.

FIG. 5
Wound treated with Biœstrogen after eight days.

FIG. 6
Microphoto after six hours (ointment). (Medium magnification). Marginal necrosis with weak] leucocytic infiltration.

(Article by I. N. Likar, E. Walter and E. Gavez on page 152)

XUM

PLATE II

FIG. 7

Microphoto after six hours (Biœstrogen). (Medium magnification.) Marginal necrosis (left) and leucocytic infiltrations with initial mesenchymal reaction.

FIG. 8

Microphoto after 120 hours (powder). (Low magnification.) Detritus from suppurative granulation with destroyed myo-elements (left) ; new wave of granulation (right).

FIG. 9

Microphoto after 120 hours (ointment). (Low magnification.) Epithelium in a stage of hyperkeratosis; suppurative destruction of granulation and narrow zone of unaffected granulation.

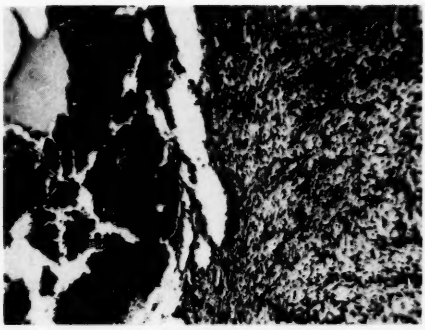

FIG. 10

Microphoto after 120 hours (Biœstrogen in linseed oil). (Low magnification.) Purulent detritus (left) which is separated from granulation (right).

(*Article by I. N. Likar, E. Walter and E. Gavez on page 152*)

contemplate at all the fact that the entire skeleton of a horse ossifies only with its fifth year of age, so that the break of continuity could correspond to a non-ossified epiphysial cartilage.

It was precisely this insistence on fibulæ fractures on the part of American authors that challenged us to investigate the clinical pattern of artificially produced fractures of the fibula. In the description of our surgical investigations, both surgically produced fractures of the fibula and artificial traumata which could be considered in connection with such fractures did not produce any permanent lameness. The brief post-operative lameness should be ascribed to motor dysfunction of the peroneal nerve caused either by presurgical anæsthesia or by injury sustained during the operation. It should be emphasised that all fractures described up to date were based upon the radiographically established discontinuity of the fibula, which, on one hand, is encountered in more than 50 per cent of normal horses, and, cannot be differentiated rœntgenologically from genuine fractures. Our own endeavours at causing a fracture of the fibula in the cadaver by means of grossest insults met with failure. This can be explained if one considers that the fibula is fixed on one side only, that its distal end remains free, and movable and flexible. It seems that fractures could only ensue from such injuries as would sever the fibula itself and the muscles surrounding it, or in association with fracture of the tibia. Such incidents are so rare that they hardly need be considered.

Conclusion

On the basis of radiographical, anatomical, histological and surgical examination we consider that:

The discontinuity of the fibula hitherto diagnosed as fracture represents a normal phenomenon for this bone, occurring in over 50 per cent of clinically healthy horses, two-thirds of which present bilateral discontinuity and about 10 per cent may show 2 or more breaks in the same fibula.

Although the break in continuity is to be found in about two-thirds of the animals in the area of the proximal epiphysial cartilage, histological findings present—instead of hyaline cartilage—degeneration and necrosis of the cartilaginous tissue in the region.

Artificial fractures of the fibula do not result in permanent lameness, formation of callus entirely fails to take place.

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THE ACTION OF BICŒSTROGEN ON WOUND HEALING

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RECENT research has established that the healing of a wound is influenced by various factors produced either locally, or remotely in one or more organs of the body. It is known that there are chemical agents such as leucotaxin, necrosin and pyrexin, which stimulate repair, as well as other factors which either stimulate or inhibit leucocytosis and growth of tissue (Menkin).

Hormones are also of great importance in the healing of a wound. This has been proved by the inhibition of repair which occurs when certain hormones are excluded from the system following the extirpation of the relevant endocrine gland (Selye). Conversely, where hormones are lacking, replacement therapy accelerates healing, e.g. corticosteroid therapy following adrenalectomy or insulin-therapy after excision of the pancreas. However, the part played by the endocrine system in tissue regeneration is not clear. Adrenaline-therapy alone is not effective in repair following adrenalectomy (Selye), in spite of the fact that adrenaline alone will stimulate epithelial growth when the adrenal glands are *in situ* (Rauch). Similarly, differences in the degree of fibroplasia occur when thyroid extract is used in normal and also thyroidectomised animals (Selye, Rauch). The role of insulin in tissue repair is also obscure, though it is suggested that the hormone raises the ability of the damaged tissues to utilize glucose as a source of energy for the metabolic processes involved in regeneration.

Research workers have tried over the last few years to elucidate some of the actions of hormones associated with tissue repair. They have found that heparin, cortisone and A.C.T.H. have an inhibitory action, whilst desoxycortisone acetate and testicular extracts stimulate repair. Li-Voti has shown that there is a correlation between the stimulatory effect of œstrogens and androgens and the synthesis of ribonucleic-acid in the cells of healing tissue. There are no reports in accessible literature concerning the effect of various extracts of the œstrogenic hormones obtained from stallions' urine on wound-healing and therefore we have carried out experiments with a view to ascertaining the effect they may have upon tissue repair, and particularly on epithelialisation and granulation.

From these experiments we believe that the extract from stallions' urine obtained by the method of L.J. and I. N. Likar and named " Bicœstrogen " possesses greater biological activity than pure crystalline œstrogenic hormones and would suggest that there are other factors combined with the steroids which have either an additive or synergistic action.

Clinical Observations

Wounds which had not shown normal progress were selected for treatment with Biœstrogenic ointments. In most instances they were wounds of long standing which had failed to heal by first intention, e.g. deep wounds, with tissue loss, in the gluteal region of horses which had broken down after suturing and were healing by second intention. Some were wounds in which granulation and epithelialisation were abnormal due to various causes, e.g. wounds resulting from the removal of large tumours and from quittor operations. A great number of wounds were treated, but we refer in this paper to fifty cases only which were subjected to close clinical observation.

In these selected cases the Biœstrogenic ointments were applied after thorough cleaning and, where necessary, debridement with the removal of necrotic tissue or excessive granulation. Some were bandaged, the dressings being renewed at suitable intervals. The amount of ointment used and the frequency of application were varied according to the type of wound.

Results

Within 24 hours the wounds had lost their smell and looked fresh ; the granulation tissue had lost its pale unhealthy appearance and assumed a bright red healthy texture. Dead tissue was reduced in amount and was separated from the healthy tissue by a clear demarcation line. New epithelium could be observed at the edges of the wound. After 48 hours the wound surfaces were covered with vigorous, dry granulation tissue, whilst epithelial growth had produced a well-defined border. (This measured several millimetres by the third day). (See Fig. 1.)

In deep wounds, in which there was a considerable degree of tissue destruction and loss, rapid granulation and epithelialisation followed Biœstrogen treatment.

Wounds which were bandaged tended to exhibit an overgrowth of granulation tissue but, following cauterisation, healing occurred much more rapidly than normal.

Frequently, there was hæmorrhage when the bandages were removed for redressing. This was due to adherence of the bandage to the wound following the rapid absorption of the ointment. Because of this and also the damage caused to new epithelium it was decided to dispense with bandages wherever possible.

After two years' experience of the use of Biœstrogen in clinical practice it was felt that adequate control of granulation and growth of epithelium could be achieved by the application of thin layers of ointment. Where there was a tendency to excess granulation, thick applications at the edges and thin layers in the centre checked the excess efficiently.

Experimental Trials

Encouraged by the results of clinical trials a more precise investigation was planned.

Ten rabbits of the same breed, age and sex, of approximately the same weight, and reared under the same conditions, were selected and wounds were made over both right and left scapulæ. The wounds were made by reflecting and removing a 2-cm. square of skin and subcutaneous tissue. Although the excised tissue squares were identical in size, the dimensions of the resulting wounds varied because of the

unequal elasticity of the skin of different individuals. For this reason each wound was measured before treatment commenced.

Aseptic precautions were not observed for it was desired to work under conditions similar to those met in practice.

To establish whether the Biœstrogen acted locally or systematically subsequent to absorption, the left scapula wounds of one group were treated either with an antiseptic dusting powder or with an antiseptic ointment, whilst the right scapula wounds were treated with Biœstrogen ointment. (See Table 2 ; the rabbits Nos. 7, 8, 9 and 10.) The remaining wounds were treated according to the scheme shown in Table 2.

The rabbits were observed and the wounds dressed daily over a 20-day period.

Results

Although strict comparison of all the wounds was not possible owing to the initial discrepancy in size, the results shown in Tables 1 and 2 are quite significant and the differences in rate of healing can be seen very clearly. Table 1 compares the effect of four different agents on four wounds of approximately the same initial size.

TABLE I

Identification number of rabbits	Treatment		∅ Diameter of the wounds in cm.		Remark
			Initial	after 20 days	
9	Powder		4·9	1·8	
10	Ointment		5·0	4·5	Exit on 17th day
5	Bioestrogen in	Cod-liver oil	5·0	0·4	
7	Bioestrogen in	Linseed oil	5·5	0·4	

Remarks:- in the animals numbered 9 & 10 the left wounds were measured and in the animals 5 & 7 the right.

Powder Therapy

It was established during the experiment that the healing rate of wounds treated with powder was similar no matter what antiseptic powder was used. Scabs formed, they were strongly adherent and on removal damage was caused to granulation tissue and epithelium. A thick, greenish-yellow sticky pus was present around the scabs. (Figs. 2 and 3.)

Ointment Therapy

The wounds dressed with the ointment showed necrotic changes and suppuration. Two rabbits (Table 2, Nos. 2 and 10) showed signs of toxæmia and died on the sixth and seventeenth days of treatment. The treatment of rabbit No. 8 was stopped after 16 days on the ointment dressing as the wounds showed no progress and the general condition of the animal was poor. The dressing of the right wound with Biœstrogen ointment was continued. There followed a rapid improvement in the healing of the left scapula-wound which previously has shown neither reduction in size, nor signs of healing. It measured 3 cm. by 2.5 cm. on the seventeenth day of the experiment. Three days after stopping the antiseptic ointment this wound had decreased in size to 2.4 cm. by 1.8 cm. in spite of the exhausted state of the animal. The general condition improved and the rabbit survived to the end of the experiment. The right scapula wound which was treated from the outset with Biœstrogen ointment only, was initially larger than the left scapula wound (3.9 cm. diameter) but twenty days later it was reduced to 0.5 cm. diameter. (See Table 2).

TABLE II

Identification number of the rabbits		1	2	3	4	5	6	7	8	9	10
				BIOESTROGEN							
Left wound		Powder	Ointment	Linseed oil	Cod-liver oil	Linseed oil	Linseed oil	Powder	Ointment	Powder	Ointment
Diameter of the wounds in Cm.	1st day	5	4	4 x 3·8	3·8	5	4 x 3·5	4·8	3·5 x 3	4·9	5
	20th day	Samples taken for histological examination				I·I	I·5	I x 0·6	2·4 x I·8	I·8	4·5
	20th day	2 x I·4	5th day exit	I x 0·3	0·I	0·4	0·5	0·4	0·5	0·3	3
	1st day	5	5 x 3·9	5 x 4·2	4 x 3·8	5	3·8 x 3·5	5·5	3·9	3·5 x 3·2	4
				BIOESTROGEN							
Right wound		Powder	Ointment	Linseed oil	Cod-liver oil	Cod-liver oil	Cod-liver oil	Linseed oil	Linseed oil	Cod-liver oil	Cod-liver oil

Biœstrogen-Therapy

The wounds treated with Biœstrogen ointment were hyperæmic and bled easily; granulation was rich, bright red and of a healthy appearance. Epithelial growth was stronger and growing more rapidly than that in the control wounds (Figs. 4 and 5). There were no hard scabs and a thin brown covering which formed could be removed easily and without damage to granulation tissue or epithelium. The edges of the wounds were defined clearly and the condition of the surfaces was clean and easily controlled. No suppuration occurred despite the lack of aseptic precautions.

Biopsy Reports

In order to record and compare the histological progress resulting from the different treatments, biopsy samples were taken at intervals from the edges of the wounds in rabbits 1 to 4. In each case samples were taken after 6, 12 and 24 hours, and 2, 3, 5, 7, 10 and 14 days. Each sample was taken from an entirely different site on the periphery so that an accurate picture was obtained of the progress of healing achieved over the period prior to each biopsy (Table 3). More than 1,000 sections were examined during the experiment : staining was by Hæmatoxylin-eosin and van Giesen. (Figs. 6, 7, 8, 9 and 10).

TABLE III

Treatment		Time	HOURS			DAYS					
			6	12	24	2	3	5	7	10	14
Powder		Granulation	+	+ +	+ + + +	+ + +	+ + + +	2mm	3-5mm		
		Cicatrization	-	-	-	-	-	-	-	+	+ +
		Epithelialization	-	-	-	-	+	+ +	+ +	+ +	+ +
MICROSPORE	Ointment	Granulation	-	-	+	+ +	+ + +	0·7mm	DEATH		
		Cicatrization	-	-	-	-	-	-			
		Epithelialization	-	-	-	-	-	-			
	Linseed oil	Granulation	+ +	+ + +	+ + + +	+ + + +	+ + + +	6mm	9mm		
		Cicatrization	-	-	-	-	-	-	+	+ +	+ +
		Epithelialization	-	-	-	-	-	+	+ +	+ +	+ +
Cod-liver oil		Granulation	+	+ +	+ + +	+ + + +	+ + + +	5mm	8mm		
		Cicatrization	-	-	-	-	-	-	-	+	+ +
		Epithelialization	-	-	-	+	+ +	+ +	+ +	+ +	+ +

Granulation:- + Activation of fibroblasts.
+ + Initial granulation.
+ + + Obvious granulation.
+ + + + Significant granulation.

Cicatrization:- + Commencement of cicatrization.
+ + Cicatrization in course.
+ + + Mature connective tissue

Epithelialisation:- + Commencement of epithelialisation
+ + Epithelialisation in course

Powder Treated Wounds

At six hours the surface of the wound was covered by a crust of clotted blood whilst the area below showed hyperæmia with emigration of leucocytes from the capillaries. The leucocytic infiltration showed either a diffuse or a focal disposition in the superficial tissue, but in the areas more remote from the crust. The position of leucocytes was mainly perivascular. The zone immediately below the crust showed signs of fibroblastic activity in addition to the leucocytic infiltration. Marginal necrosis was not present.

At twelve hours marginal necrosis was marked and there was a wide leucocytic zone, but it appeared that leucocytic infiltration was slowing down whilst connective tissue proliferation was developing. At 24 hours there was a narrow zone of granulation tissue which at 48 hours was beginning to change to pus. In the deepest part of the wound a new layer of intensive granulation appeared, which at five days had reached a thickness of 2,000 microns, and at seven days was from 3,000 to 5,000 microns, depending on the initial depth of the wound. Reabsorption of destroyed myofibrils was observed in the inter-muscular granulation, and polykaryocytic giant cells of myogenic and angioplastic origin were noticed also.

At 10 days maturation of the long-standing granulation tissue could be seen with a reduction in vascularity and increased fibrosis. By the 14th day cicatrization was advanced but some vascularity was still evident.

Epithelial encroachment on the wound commenced 72–120 hours after the excision.

Ointment Treated Wounds

At six hours marginal necrosis was present with significant pericapillary infiltra-

tion but less diffuse infiltration, whilst the zone of leucocytic infiltration around the periphery of the wound was less well defined than in the wound treated with powder.

At 12 hours the marginal necrotic zone as well as the leucocyte zone had become wider than the corresponding layers in the powder treated wound after a similar period. Necrosis with leucocyte destruction commenced with the beginnings of a suppurative cellulitis ; mesenchymal activity was absent.

At 24 hours complete pyogenic destruction of the leucocyte demarcation zone had taken place but below this a discreet layer of new granulation tissue was evident. The cellulitis had continued to spread. Subepithelial œdema and extravasation of erythrocytes had occurred and a swelling of muscle fibre nuclei was apparent with the development of a homogenous appearance of the myofibrils.

At 48 hours the layer of granulation under the thick necrotic zone was growing and by 120 hours it was about 700 microns wide : the epidermis around the edge was keratinised.

Further observations could not be made owing to the death of the rabbit on the 6th day.

Biœstrogen-Treated Wounds

(*a*) Biœstrogen in linseed-oil (25 per cent in an ointment base containing lanolin).

At six hours there was a diffuse and perivascular leucocytic infiltration in the tissue surrounding the wound, with signs of fibro-angioplastic awakening, and a canalisation of the angioplastic buds in the subcutaneous tissue. Marginal necrosis was very slight.

At 12 hours there was a wide unequal marginal necrosis with some penetration of granulation tissue into it. Leucocytosis in the surrounding tissue was slight.

At 24 hours the granulation was significant and by 48 hours it had progressed into a wide zone which at 72 hours was destroyed in necrobiosis. Below this necrobiotic zone a leucocytic demarcation zone with strong granulation was observed. This strong granulation was by 120 hours 6,000 microns thick and by 168 hours (seven days) had reached about 9,000 microns. Muscle tissue had been invaded by granulation whilst increased activity of myo-nuclei with the formation of polynuclear cells was observed along with an increase in basal epidermal cell activity.

At 10 days there was marked evidence of fibrosis in the older granulation tissue, but the superficial tissue was still highly vascular.

At 14 days there was compact fibrous tissue, no signs of infiltrating cells and vascularization was abnormally reduced. The tissue showed little difference from healthy skin. Epithelialization commenced 100–120 hours after the excision.

(*b*) Biœstrogen in a Cod-Liver Oil Base.

At six hours there was a marginal necrosis with feeble perivascular cuffing and no significant infiltration in its surroundings.

At 12 hours a wide demarkation zone of leucocytes undergoing destruction was apparent below the superficial necrosis. Granulation tissue was appearing and was very evident at 48 hours. Subsequently this activity failed and the layer was isolated by a band of leucocytic infiltration. This in turn was followed by a strong wave of granulation which reached a thickness of approximately 5,000 microns by 120 hours (five days) and 8,000 microns at seven days.

At 10 days the tendency to fibrosis was marked but less so than in those wounds treated with the linseed-oil preparation. Maturation was continued even after 14 days.

Epithelialization commenced between 48 and 72 hours after the excision.

Discussion

The healing of these surgically produced open-wounds in experimental rabbits was by second intention. Significant differences in healing times occurred according to the dressing used.

The wounds treated with the commercial wound ointment throughout showed indolent granulation, with necrosis and leucocytic infiltration predominating. The development of a purulent cellulitis and the death of two animals during the experiment showed that this ointment had an unfavourable effect on tissue regeneration. This may have been due to the toxic action of the tar and was related probably to the large surface area of the wounds.

The powder treated wounds showed a satisfactory healing process similar to those usually obtained with antiseptic powders.

Those wounds dressed with the Biœstrogen-ointments healed much faster and more efficiently than the other wounds. A most important feature was the lack of suppuration when this ointment was used. Granulation was very rapid and profuse with relatively slight leucocytic infiltration, whilst fibrosis occurred in between 7 and 10 days. Cicatrization had ceased at 14 days.

There was a difference in the effect of Biœstrogen when combined with cod-liver oil and when mixed with linseed-oil. Those wounds dressed with Biœstrogen in linseed-oil showed marginal necrosis in 12 hours in contrast to six hours in those treated with the Biœstrogen in cod-liver oil. More rapid granulation and cicatrization but slower epithelial growth followed the linseed-oil application when compared with the cod-liver oil dressed wounds. It is known that an acid pH stimulates granulation but depresses epithelialization (Vodennikof, Rauch) and these wound reactions would seem to be related also to the pH and saturation of the two oils. (Linseed-oil pH 7.5 and I.N. 175–200 ; Cod-liver oil pH5 and I.N. 155–185.) The antagonism between cicatrization and regeneration of epithelium reported by Bour was apparent also.

In spite of all these factors it will be noted that the wounds treated with Biœstrogen healed more rapidly and efficiently than those dressed with either of the other two compounds. However, where wounds on the left side of one animal were treated simultaneously with the powder and those on the right side with Biœstrogen the powder-treated wounds healed more rapidly than the wounds on those animals where powder only was used. This would suggest that not only was there a local effect from the Biœstrogen but that absorption took place and exerted a beneficial effect on the tissues of the powder-treated wounds. The number of animals was too small to allow any definite conclusions.

The authors believe that some of the beneficial action was derived from the base of the ointments, the favourable actions of which are well known (cod-liver oil, linseed-oil, lanolin), but that the main effect was derived from the Biœstrogen.

Apart from the speed and efficiency of healing the lack of suppuration was most marked. This supports the idea that Biœstrogen possesses antibacterial properties.

Conclusions

(1) Biœstrogen (œstrogenic hormones and other substances with an activator or stimulant effect) was obtained from natural sources and dissolved in cod-liver oil or linseed-oil. These solutions were incorporated at a 25 per cent concentration in a lanoline ointment base.

(2) This ointment was applied to wounds, accidentally occasioned, and healing by second intention and, following satisfactory results, it was tested on experimental wounds in rabbits. Comparable wounds were treated with an antiseptic dusting powder and an antiseptic ointment. Under controlled conditions second intention healing was shown by clinical and histological means to be more rapid and effective when the Biœstrogen ointment was used.

(3) Histological examination showed that a linseed oil base gave stronger, more rapid granulation and cicatrisation but slower epithelialization than a cod-liver oil based Biœstrogen ointment.

(4) The absence of suppuration was noted and attributed partly to the speed and strength of granulation and partly to the antibacterial properties of the Biœstrogen.

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Formulae of the Powder and Ointment

Powder :	Pix. liquida	14 per cent	Manufactured under the name :
	Sterile Kaolin	86 per cent	ASEPTIN
Ointment :	Oil of Cade	10 per cent	
	Cod-liver Oil	5 per cent	
	Oil of turpentine	5 per cent	CUTISAN
Simple ointment base		80 per cent	

Both preparations are for use in veterinary practice for the treatment of wounds healing by second intention. They are produced by the State Company, Vetserum, æagreb Yugoslavia.

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NOTICE

EVANS MEDICAL SUPPLIES LIMITED announce the availability of Dermevan—a new topical biocidal agent for the treatment of footrot in sheep and ringworm in cattle. Dermevan lotion is presented in bottles of 500 cc. and is claimed to possess the well-known instantaneous bactericidal, fungicidal and antiviral activities of iodine in a new, solubilising medium which ensures greatly reduced irritation and no staining.

ERRATA

THE authors of the article " The effect of high level vitamins on the susceptibility of chickens to Salmonella Gallinarum infection ", which was published in the BRITISH VETERINARY JOURNAL, Vol. 114, 2 (February 1958), request the omission of one reference from their original manuscripts. Briggs *et al.* (1944), page 59, refers to Briggs, G. M., jnr., Luckey, T. D., Elvehjem, C. A. and Hart, E.B. (1944), *Proc. Soc. exp. Biol. Med.*, *55*, 130.